



Recent Developments/Improvements in Objective Analyses of Observations/Forecasts for Localized Aviation MOS Products at the Meteorological Development Laboratory



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1. Introduction

As part of the **Localized Aviation MOS Program (LAMP)**, the Meteorological Development Laboratory (MDL) is providing gridded observations (0-h proj.) and gridded LAMP forecast guidance (1-25-h proj.) for 2-m surface temperature (T), 2-m dewpoint temperature (Td), ceiling height (C), and visibility (V) at each hour for forecasters in preparing the National Digital Forecast Database (NDFD). This presentation focuses on **improvements over operational LAMP T/Td gridded products and new developments of LAMP 10-m wind gridded products** covering 0-25 h.

We describe the intensive effort needed to assure **temporal consistencies** between gridded observations (0h) and the first projection (1h) of gridded LAMP forecasts and also from 1h to 25h by showing a method developed with an **augmentation algorithm**. In the current operational augmentation procedures, data derived from the Short-Range Ensemble Forecast (SREF) system are used to augment the station LAMP T/Td forecasts; this augmentation was necessary to provide detail for the 2.5-km resolution grid. For this new development, we instead use **observations and MOS forecasts for augmentation**, which are adjusted with **LAMP forecasts and weighted by projection** (i.e., with higher weighting of observations in earlier projections and higher weighting of MOS forecasts in later projections). Another important capability required in our objective analysis scheme is the **effective computation of vertical changes with elevation (VCE)**. In the T/Td suite, the lapse rate for each station point is computed by using **neighboring pairs of stations** and then used to make vertical adjustments over grid points. To compute wind's VCE at each station point, we use surface and Global Forecast System (GFS) **upper level** data.

2. BCDG Scheme & Pre-Processors

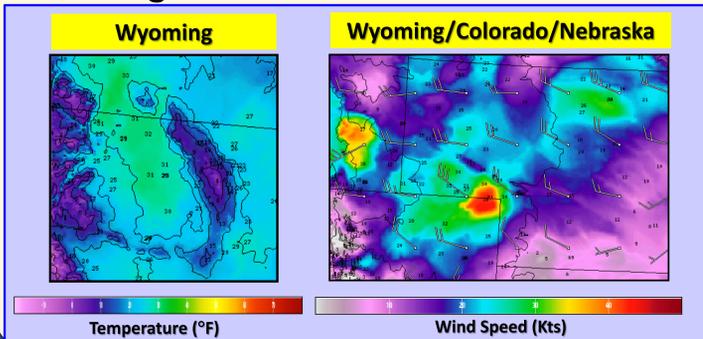
Berghorssen-Cressman-Doos-Glahn (BCDG) Objective Analysis Scheme (Glahn et al. 2009, Glahn and Im 2011, Im and Glahn 2012)

- **Successive Correction:**
Correcting each grid pt on each pass with the stn data in the immediate vicinity
- **Land/Water Sep. (Land, Ocean, Lake)**
- **Vertical Changes**
- **Variable Radius of Influence R (varies with data density)**
- **Buddy Checks (QC)**
- **Terrain-Following Smoother**
- **Spot Remover (Variable Radius Smoother)**
: Dist. to closest stn -> weighted avg. of all grid pts in the circle

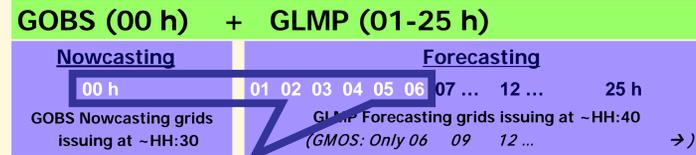
3 Pre-processors in BCDG are made to save run-time in advance.

- 1) Station Pairs to compute **Lapse Rate**
- 2) Variable **R_s** for each station
- 3) Station Pairs to compute Adjusted values for **Augmentation**

3. Fitting Observations in BCDG Scheme



4. GLMP Suite



"Critical for Aviation Operations" LAMP has been shown to be an improvement over MOS mainly by adding OBS as predictors.

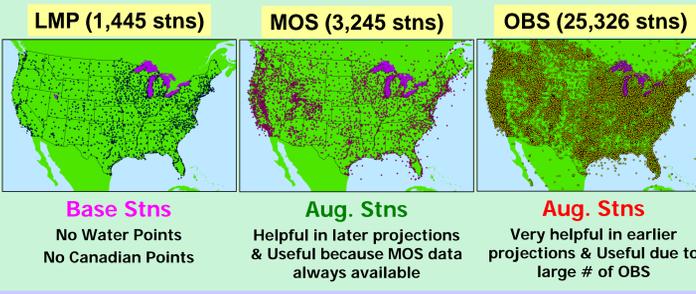
5. Problem in Current Operational GLMP Suite

Temporal Discontinuity between GOBS and GLMP
Why?

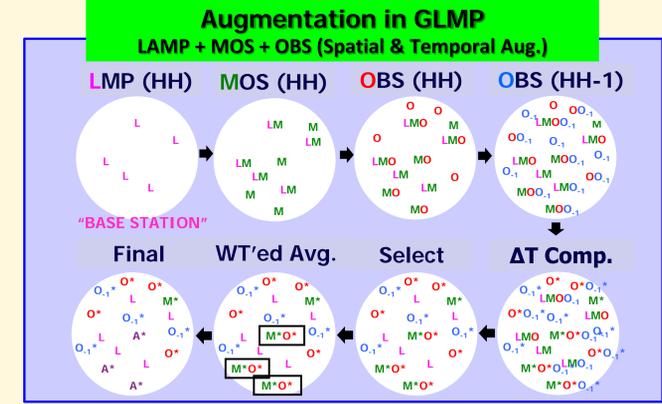
Used Short Range Ensemble Forecast (SREF) to fill LAMP Spatial Gaps

6. New Augmentation Method

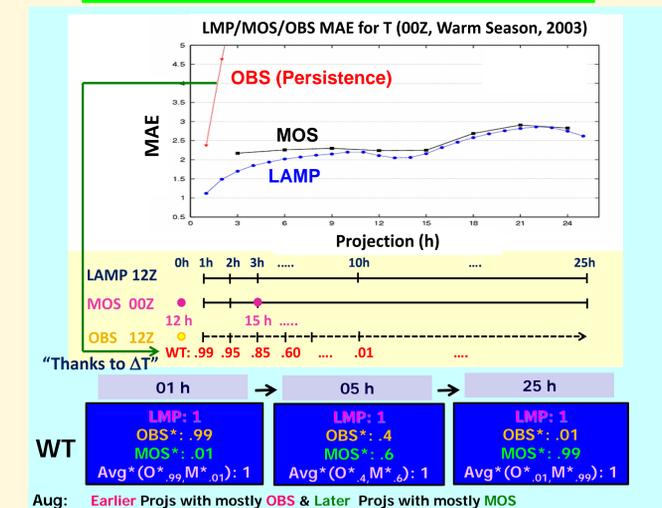
Distributions of LAMP/MOS/OBS data



6. New Augmentation Method (Cont.)

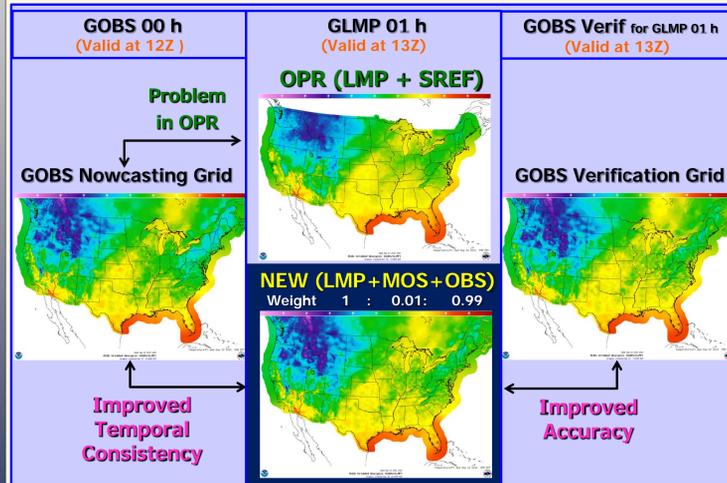


Augmentation Weighting in GLMP



7. Results: Improvements

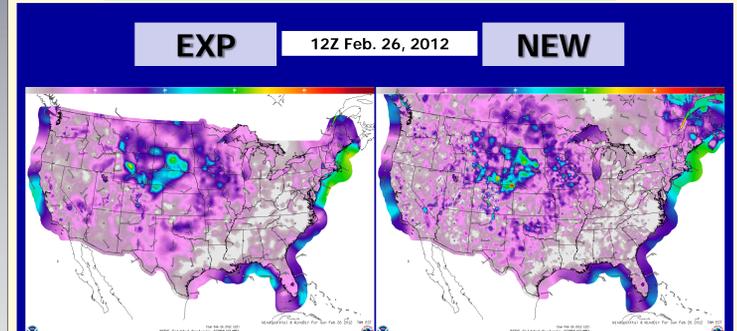
7.1. TEMPERATURE SUITE



7. Results: Improvements (Cont.)

7.2. WIND SUITE

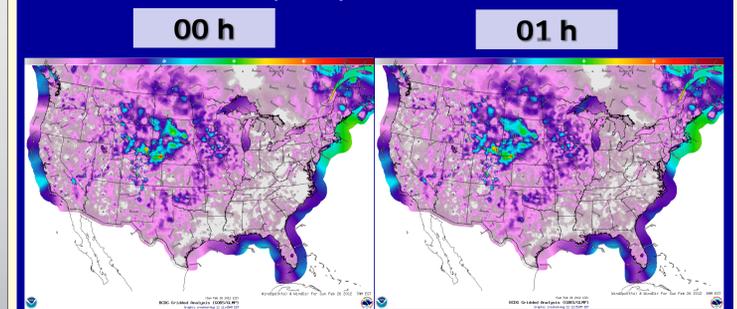
Improvements in GOBS (00 h) Wind



- Old station dictionary (much smaller # of stns)
- Vertical Change Computation by using **Neighboring Pair Stns** pre-processed
- Variable R pre-processed
- Without Variable Radius Smoother
- Recent stn. dic. (more # of stns, recent info => Details)
- Better **Vertical Change Comp.** by using Surface & GFS Upper Level Data
- + Vari. R computed **on-the-fly**
- With **Variable Radius Smoother**
- Water area improved by **MOS** & better **L/W** assign. & **Bogus** pts

Temporal Consistency

GOBS (00 h) → GLMP 01 h



Input data to GLMP: **LAMP + OBS***(adjusted by LAMP) + **MOS***(adjusted by LAMP)
WT: **1 0.9 0.1**
♦ Tossed OBS info obtained from GOBS is passed into GLMP

8. Scheduled Implementations

The Upgraded MDL GOBS/GLMP (00-25 h) T/Td/C/V and New Wind/Gust/Opaque Sky Cover will be available at NCEP Central Operations.

References

Glahn, B., and J.-S. Im, 2011: Algorithm for effective objective analysis of surface weather variables, Preprints, *24th Conf. on Weather and Forecasting*, Seattle, WA, Amer. Meteor. Soc., 10A.4.

_____, K. Gilbert, R. Cosgrove, D. P. Ruth, and K. Sheets, 2009: The gridding of MOS. *Wea. Forecasting*, 24, 520-529.

Im, J.-S., and B. Glahn, 2012: Objective analysis of hourly 2-m temperature and dewpoint observations at the Meteorological Development Laboratory. *Natl. Wea. Dig.*, 36(2), 103-114.